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CLAIMS

1. (Original) A method for requantizing coefficients of a bit stream, the method comprising:

receiving a plurality of input coefficients (F_i) quantized at an input quantization scale (q_i), the input coefficients associated with the bit stream;

providing an output quantization scale (q_o), wherein the output quantization scale is greater than the input quantization scale to allow for rate reduction of the bit stream; and

transmitting a plurality of output coefficients (F_o) quantized at the output quantization scale, wherein the plurality of output coefficients are determined using a formula minimizing the difference between dequantized input coefficients (f_i) and dequantized output coefficients (f_o).

2. (Original) The method of claim 1, wherein the quantized coefficients are DCT coefficients of an MPEG encoded bitstream.

3. (Original) The method of claim 1, wherein the plurality of input coefficients are associated with an intra macroblock or an inter macroblock.

4. (Original) The method of claim 1, wherein the output quantization scale has a larger step size than the input quantization scale.

5. (Original) The method of claim 1, wherein input and output coefficients are dequantized using the following formula:

$$f = ((2F + k) \cdot q \cdot w)/32);$$

where $k = 0$ for intra macroblocks,

$k = \text{sign}(F)$ for inter macroblocks,

"/" denotes integer division with truncation of the result toward zero,

w = weighting factor, and

sign(F) = -1, 0, or 1 if F < 0, F = 0, and F > 0 respectively.

6. (Original) The method of claim 1, wherein the formula minimizes requantization error.

7. (Original) The method of claim 6, wherein requantization error is minimized using the following formula:

$$q_{error} = \min\left|(2F_i + k_i) \cdot q_i \cdot w)/32 - (2F_o + k_o) \cdot q_o \cdot w)/32\right|;$$

where $k = 0$ for intra macroblocks,

$k = \text{sign}(F)$ for inter macroblocks,

"/" denotes integer division with truncation of the result toward zero,

w = weighting factor, and

subfix i and o in F, k and q represent input and output values respectively.

8. (Original) The method of claim 3, wherein output quantized coefficients associated with intra macroblocks are calculated using the following formula:

$$F_o = round(rF_i);$$

where r is equal to the input quantization scale divided by the output quantization scale and the round function rounds the result to the nearest integer.

9. (Original) The method of claim 8, wherein midpoints are rounded toward 0.

10. (Original) The method of claim 3, wherein output quantized coefficients associated with inter macroblocks are calculated using the following formula:

$$F_o = round\left(\frac{k_i}{2}\left[2r|F_i| + r - 1\right]\right);$$

where r is equal to the input quantization scale divided by the output quantization scale and the round function rounds the result to the nearest integer.

11. (Original) The method of claim 10, wherein midpoints are rounded toward 0.

12. (Original) An apparatus for requantizing coefficients of a bit stream, the apparatus comprising:

an input interface configured to receive a plurality of input coefficients (F_i) quantized at an input quantization scale (q_i), the input coefficients associated with the bit stream;

a processor configured to provide an output quantization scale (q_o), wherein the output quantization scale is greater than the input quantization scale to allow for rate reduction of the bit stream; and

an output interface configured to transmit a plurality of output coefficients (F_o) quantized at the output quantization scale, wherein the plurality of output coefficients are determined using a formula minimizing the difference between dequantized input coefficients (f_i) and dequantized output coefficients (f_o).

13. (Original) The apparatus of claim 12, wherein the quantized coefficients are DCT coefficients of an MPEG encoded bitstream.

14. (Original) The apparatus of claim 12, wherein the plurality of input coefficients are associated with an intra macroblock or an inter macroblock.

15. (Original) The apparatus of claim 12, wherein the output quantization scale has a larger step size than the input quantization scale.

16. (Original) The apparatus of claim 12, wherein input and output coefficients are dequantized using the following formula:

$$f = ((2F + k) \cdot q \cdot w)/32);$$

where $k = 0$ for intra macroblocks,

$k = \text{sign}(F)$ for inter macroblocks,

"/" denotes integer division with truncation of the result toward zero,

w = weighting factor, and

sign(F) = -1, 0, or 1 if $F < 0$, $F = 0$, and $F > 0$ respectively.

17. (Original) The apparatus of claim 12, wherein the formula minimizes requantization error.

18. (Original) The apparatus of claim 17, wherein requantization error is minimized using the following formula:

$$q_{error} = \min\left|(2F_i + k_i) \cdot q_i \cdot w)/32 - (2F_o + k_o) \cdot q_o \cdot w)/32\right|;$$

where $k = 0$ for intra macroblocks,

$k = \text{sign}(F)$ for inter macroblocks,

"/" denotes integer division with truncation of the result toward zero,

w = weighting factor, and

subfix i and o in F, k and q represent input and output values respectively.

19. (Original) The apparatus of claim 14, wherein output quantized coefficients associated with intra macroblocks are calculated using the following formula:

$$F_o = round(rF_i);$$

where r is equal to the input quantization scale divided by the output quantization scale and the round function rounds the result to the nearest integer.

20. (Original) The apparatus of claim 19, wherein midpoints are rounded toward 0.

21. (Original) The apparatus of claim 14, wherein output quantized coefficients associated with inter macroblocks are calculated using the following formula:

$$F_o = round\left(\frac{k_i}{2}\left[2r|F_i| + r - 1\right]\right);$$

where r is equal to the input quantization scale divided by the output quantization scale and the round function rounds the result to the nearest integer.

22. (Original) The apparatus of claim 21, wherein midpoints are rounded toward 0.

23. (Original) A computer readable medium comprising computer code for requantizing coefficients of a bit stream, the computer readable medium comprising:

computer code for receiving a plurality of input coefficients (F_i) quantized at an input quantization scale (q_i), the input coefficients associated with the bit stream;

computer code for providing an output quantization scale (q_o), wherein the output quantization scale is greater than the input quantization scale to allow for rate reduction of the bit stream; and

computer code for transmitting a plurality of output coefficients (F_o) quantized at the output quantization scale, wherein the plurality of output coefficients are determined using a formula minimizing the difference between dequantized input coefficients (f_i) and dequantized output coefficients (f_o).

24. (Original) The computer readable medium of claim 23, wherein input and output coefficients are dequantized using the following formula:

$f = ((2F + k) \cdot q \cdot w)/32);$

where $k = 0$ for intra macroblocks,

$k = \mathrm{sign}(F)$ for inter macroblocks,

"/" denotes integer division with truncation of the result toward zero,

w = weighting factor, and

sign(F) = -1, 0, or 1 if $F < 0$, $F = 0$, and $F > 0$ respectively.

25. (Original) The computer readable medium of claim 23, wherein the formula minimizes requantization error.

26. (Original) The computer readable medium of claim 25, wherein requantization error is minimized using the following formula:

$q_{error} = \min|(2F_i + k_i) \cdot q_i \cdot w)/32 - (2F_o + k_o) \cdot q_o \cdot w)/32|;$

where $k = 0$ for intra macroblocks,

$k = \mathrm{sign}(F)$ for inter macroblocks,

"/" denotes integer division with truncation of the result toward zero,

w = weighting factor, and

subfix i and o in F, k and q represent input and output values respectively.

27. (Original) An apparatus for requantizing coefficients of a bit stream, the apparatus comprising:

means for receiving a plurality of input coefficients (F_i) quantized at an input quantization scale (q_i), the input coefficients associated with the bit stream;

means for providing an output quantization scale (q_o), wherein the output quantization scale is greater than the input quantization scale to allow for rate reduction of the bit stream; and

means for transmitting a plurality of output coefficients (F_o) quantized at the output quantization scale, wherein the plurality of output coefficients are determined using a formula minimizing the difference between dequantized input coefficients (f_i) and dequantized output coefficients (f_o).

28. (Original) The apparatus of claim 27, wherein input and output coefficients are dequantized using the following formula:

$f = ((2F + k) \cdot q \cdot w)/32);$

where $k = 0$ for intra macroblocks,

$k =$ sign(F) for inter macroblocks,

"/" denotes integer division with truncation of the result toward zero,

w = weighting factor, and

sign(F) = -1, 0, or 1 if F < 0, F = 0, and F > 0 respectively.

29. (Original) The apparatus of claim 27, wherein the formula minimizes requantization error.

30. (Original) The apparatus of claim 29, wherein requantization error is minimized using the following formula:

$q_{error} = \min|(2F_i + k_i) \cdot q_i \cdot w)/32 - (2F_o + k_o) \cdot q_o \cdot w)/32|;$

where $k = 0$ for intra macroblocks,

$k =$ sign(F) for inter macroblocks,

"/" denotes integer division with truncation of the result toward zero,

w = weighting factor, and

subfix i and o in F, k and q represent input and output values respectively.

31. (Currently Amended) The apparatus of claim 30, wherein output quantized coefficients associated with intra macroblocks are calculated using the following formula:

$F_o = round(rF_i);$

where r is equal to the input quantization scale divided by the output quantization scale and the round function rounds the result to the nearest integer.